Properties of Logarithms
Section 4.3

(Don't forget to look for the logarithmic properties handout.)

Learning Objectives:

1. Use the product rule.
2. Use quotient rule.
3. Use the power rule.
4. Expand logarithmic expressions.
5. Condense logarithmic expressions.
6. Use the change-of-base property.

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1. Use properties of logarithms to expand the logarithmic expression as much as possible. When possible, evaluate logarithmic expressions without using a calculator.

$$\log_8(11 \cdot 13)$$

2. Use properties of logarithms to expand the logarithmic expression as much as possible. When possible, evaluate logarithmic expressions without using a calculator.

$$\log(100x)$$

3. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\log_{13}\left(\frac{13}{y}\right)$$

4. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\ln\left(\frac{e^2}{14}\right)$$

5. Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

$$\log_b(x^3)$$

6. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\ln \sqrt[13]{x}$$

7. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\log_b(x^7 z)$$

8. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\log_b\left(\frac{x^2 y}{z^6}\right)$$

9. Use properties of logarithms to expand the logarithmic expression as much as possible.

$$\log_d \frac{\sqrt{a}b^5}{c^2}$$

10. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$\log 125 + \log 8$$

11. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$\ln(x) + \ln 20$$

12. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$\log_4 24 - \log_4 6$$

13. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$\log(5x + 1) - \log(x)$$

14. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$\frac{1}{3}\ln y + \ln z$$

15. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$2\log_b x + 7\log_b z$$

16. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$7\ln x - \frac{1}{4}\ln y$$

17. Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1.Where possible, evaluate logarithmic expressions.

$$2\ln x + 5\ln y - 4\ln z$$

18. Use common logarithms or natural logarithms and a calculator to evaluate the expressions. (Round to four decimal places as needed)

$$\log_{16} 12$$

19. Use common logarithms or natural logarithms and a calculator to evaluate the expressions. (Round to four decimal places as needed)

$$\log_{14} 88.5$$

20. Use common logarithms or natural logarithms and a calculator to evaluate the expressions. (Round to four decimal places as needed)

$$\log_{0.3} 28.6$$

Answer Key:

1.	$\log_8 11 + \log_8 13$
2.	$2 + \log x$
3.	$1 - \log_{13} y$
4.	$2 - \ln 14$
5.	$3\log_b x$
6.	$\frac{1}{13}\ln x$
7.	$7\log_b x + \log_b z$
8.	$2\log_b x + \log_b y - 6\log_b z$
9.	$\frac{1}{2}\log_d a + 5\log_d b - 2\log_d c$
10.	3
11.	$\ln(20x)$
12.	1
13.	$\log\frac{5x+1}{x}$
14.	$\ln(z\sqrt[3]{y})$
15.	$\log_b(x^2z^7)$
16.	$\ln\frac{x^7}{\sqrt[4]{y}}$
17.	$\ln\left(\frac{x^2y^5}{z^4}\right)$
18.	0.8962
19.	1.6987
20.	-2.7853